CTE Standards Unpacking
Structural Analysis and Damage Repair

Course: Structural Analysis and Damage Repair
Course Description: Students will measure and repair structural and frame damage. The desire for the students to receive industry based training at the basic level and step up to higher level of competency in this field is the ultimate goal of this course.
Career Cluster: Transportation, Distribution & Logistics
Prerequisites: Introduction to Auto Body & Estimating 20120
Program of Study Application: Structural Analysis and Damage Repair is an advanced pathway course in the Transportation, Distribution and Logistics career cluster, Automotive Body Collision and Refinishing pathway.

INDICATOR #SA 1: Students will demonstrate auto body technology safety practices.	

SUB-INDICATOR 1.1 (Webb Level: 2 Skill/Concept): Demonstrate auto body technology safety practices

Knowledge (Factual):	Understand (Conceptual):	Do (Application):
-Proper personal safety equipment -Federal, state, and local regulations for HAZMAT -Vehicle specific service information, procedures and precautions -Vehicle system hazard types, locations, and recommended procedures needed before completing a repair.	-Consequences of not using personal safety equipment -Consequences of not following safety regulations -Importance of following the procedure in order -Hazard types and safety procedures while working.	-Select and use proper personal safety equipment. -Take necessary precautions with hazardous operations and materials. -Locate procedures and precautions that may apply to the vehicle being repaired. -Select and use a National Institute of Occupational Safety and Health (NIOSH) approved air purifying respirator.

Benchmarks:
Students will be assessed on their ability to:
- Complete of NTAEF tasks pertaining to safety.
- Obtain *OSHA 10 Certification*
- Complete personal safety equipment checklist.

- Complete federal, state and local regulations checklist pertaining to one area of auto body repair.
- Create an artifact using service information.

Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
SL4. Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.	-Role-play the part of service technician and customer to simulate vehicle system hazards

INDICATOR #SA 2: **Students will inspect and repair frames.**
SUB-INDICATOR 2.1 (Webb Level: 2 Skill/Concept): Measure and analyze structural damage
SUB-INDICATOR 2.2 (Webb Level: 2 Skill/Concept): Make necessary repairs to the frame

Knowledge (Factual):	Understand (Conceptual):	Do (Application):
-Terminology and concepts used in structural diagnosis and repair. -Components and layout of frame rack, measuring devices and clamping fixtures -Expanding foams -Tram Gauge and how to operate -Crush & collapse zones -Anchoring devices	-Importance of following proper procedure and sequence -Significance of heat and fatigue issues relating to structural components -Differences in measuring systems -How placement of anchoring devices affects the pull -Proper usage of expanding foams	-Measure and diagnose structural damage -Determine the extent of direct and indirect damage and the direction of impact -Attach vehicle to anchoring devices. -Pull damage from the frame -Demonstrate an understanding of structural foam applications.

Benchmarks:

Students will be assessed on their ability to:

- Completion of NTAEF tasks pertaining to frame inspection and repair.
- Proper setup and repair of frame damage as measured with tram gauge.

Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
SL4. Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.	-Explain correct setup procedure for repairing frame damage.
HS-PS2-2 Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.	-Create a mathematical model to replicate the damage that a vehicle has incurred

INDICATOR #SA 3: **Students will inspect, measure and repair unibody and unitized structures.**		
SUB-INDICATOR 3.1 (Webb Level: 2 Skill/Concept): Analyze and determine unibody and unitized structural damage		
SUB-INDICATOR 3.2 (Webb Level: 2 Skill/Concept): Repair unibody and unitized structures		
Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-Terminology and concepts used in structural diagnosis and repair. -Components and layout of frame rack, measuring devices and clamping fixtures	-Why placement of vehicle components may impact attachment of anchoring devices -How order of impact plays role in order of repair -Importance of documentation	-Measure and diagnose unibody damage -Determine the extent of the direct and indirect damage and the direction of impact; plan and document the methods and sequence of repair.

| -Proper Operation of Measuring Systems

-Crush & collapse zones

-Anchoring devices

-Build procedure and attachment methods of structural components

-Direct and Indirect Damage | -Consequences of corrosion protection on repaired or replaced structural areas | -Attach anchoring devices to vehicle; remove or reposition components as necessary.

-Remove and replace damaged structural components.

-Restore corrosion protection to repaired or replaced structural areas and anchoring locations. |
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Benchmarks:
Students will be assessed on their ability to:
- Complete NTAEF tasks that pertain to inspection, measuring and repair of unibody and unitized structures. *Examples:* Inspect, measure and assess damage of unibody.
- Proper repair of unitized structure.
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Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
SL4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range or formal and informal tasks	-Create a PowerPoint presentation that explains how to determine direct and indirect damage to a vehicle.
M-GM 2. Apply concepts of density based on area and volume in modeling situations	-Calculate the amount of repair materiel needed for specific damage on a mock vehicle

INDICATOR #SA 4: Students will inspect and repair or replace stationary glass.

SUB-INDICATOR 4.1 (Webb Level: 2 Skill/Concept): Inspect vehicles for glass damage and determine manufacturer's specifications for glass window replacement

Knowledge (Factual):	Understand (Conceptual):	Do (Application):
-Terminology -Stationary glass systems -Proper removal and installation of advanced glass systems	-Roles that stationary glass plays in the construction and operation of the vehicle -Consequences of not correctly installing glass systems according to procedures (e.g., leaks, structural integrity)	-Identify considerations for removal, handling, and installation of advanced glass systems. -Remove and reinstall or replace modular glass using recommended materials. -Check for water leaks, dust leaks, and wind noise.

Benchmarks:
Students will be assessed on their ability to:
- Complete NATEF tasks that pertain to stationary glass.
- Project that demonstrates proper safety and correct installation of glass systems (e.g., remove and replace windshield, quarter glass).
- Proper repair of and/or proper replacement of stationary glass.

Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
SL1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led).	-Discuss the factors that determine replacement versus repair of a windshield
M-GM 2. Apply concepts of density based on area and volume in modeling situations	-Calculate the amount of glass needed to repair the damage to a vehicle

INDICATOR #SA 5: **Students will demonstrate proficiency in welding, cutting and joining.**

SUB-INDICATOR 5.1 (Webb Level: 1 Recall): Analyze and identify correct welding procedures to be used in auto body repair work

SUB-INDICATOR 5.2 (Webb Level: 2 Skill/Concept): Perform proper welding operations to specific auto body repairs

Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-Safety in welding equipment	-Effects of heat (distortion, pull) on metal and other parts of the car and how that applies to the task at hand in order to select the correct process for the job	-Set up welder for specific repair to be done
-Welding, cutting, and joining processes		-Protect adjacent panels, glass, vehicle interior, etc. from welding and cutting operations.
-Welding equipment setup and operation	-Defects in weldments and what causes them	-Clean and prepare the metal to be welded.
-Weld test procedures		-Perform various welds.
		-Perform visual evaluation and destructive test on each weld type.
		-Identify the causes of various welding defects; make necessary adjustments.
		-Perform cutting processes for different substrates and locations.

Benchmarks:
Students will be assessed on their ability to:
- Complete NTAEF tasks that pertain to welding, cutting and joining.
- Proper setup and operation of welding machine.
- Destructive welding test and evaluation.
- Metal preparation and various weldments on metal thicknesses used in collision repair.
- Rust repair panel on pickup box side.

Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
SL1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led).	-Discuss the correct procedures needed to prepare a piece of metal for a weld
HS-PS1-3 Plan and carry out an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles	-Compare the various types of materials used to weld

Additional Resources

Please list any resources (e.g., websites, teaching guides, etc.) that would help teachers as they plan to teach these new standards.

ASE Education Foundation -- http://www.aseeducation.org/resources